215.9

A MODEL OF 7-14 HZ SPINDLING IN THE THALAMUS AND THALAMIC RETICULAR NUCLEUS: INTERACTION BETWEEN INTRINSIC AND NETWORK PROPERTIES

A. Destexhe*, W.W. Lytton‡, T.J. Sejnowski, D.A. McCormick¶, D. Contreras§ and M. Steriade§. The Salk Institute, Computational Neurobiology Laboratory, PO Box 85800, San Diego, CA 92186, USA; ‡ Dept. Neurology, University of Wisconsin, Madison, WI 53706-1532, USA; ¶ Section of Neurobiology, Yale University, New Haven CT-06510, USA; § Lab. of Neurophysiology, Laval University, Quebec, CANADA G1K 7P4.

We have developed models of thalamocortical (TC) and reticular thalamic (RE) neurons that included voltage-dependent currents with Hodgkin-Huxley type kinetics based on voltage-clamp and current-clamp measurements.

Single TC neurons generated slow (0.5-4 Hz) rhythmic firing through an interaction of the low-threshold Ca^{2+} current and a hyperpolarization-activated cation current I_h. We studied how the various patterns of slow oscillation can be controlled by current injection, synaptic input and degree of activation of I_h. Slow oscillations could wax and wane if the voltage dependence of I_h was sensitive to intracellular Ca^{2+}. Single RE neurons generated 8-10 Hz rhythmic burst firing through an interaction of I_T and a Ca^{2+}-activated K^+ current. These oscillations were generated following injection of a current step and were followed by tonic tail activity. We also investigated similar oscillatory modes in networks of RE cells interconnected via inhibitory synapses.

We investigated networks in which EPSPs were included onto RE cells from TC cells and IPSPs from RE onto TC cells. We found waxing and waning 8-10 Hz oscillations separated by silent periods of 8-30 s. The properties of these oscillations are characteristic of the spindles observed *in vivo* and in ferret slices *in vitro*.

This mathematical model confirms previous *in vivo* and *in vitro* data emphasising the role of both intrinsic and network properties in the generation of synchronized oscillations in the thalamus.